IN THE CLAIMS

Add new claims 19-31 as follows:

1. (Original) A method for manufacturing a semiconductor device comprising the steps of:

(a) depositing a silicon nitride film on a semiconductor substrate;

(b) depositing a base electrode forming silicon film of a bipolar transistor on the silicon nitride film;

(c) depositing a first silicon oxide film on the base electrode forming silicon film;

(d) forming an aperture that reaches the silicon nitride film on the first silicon oxide film and the base electrode forming silicon film;

(e) forming a second silicon oxide film on the side surface of the base electrode forming silicon film that is exposed from the aperture by applying oxidation treatment on the semiconductor substrate;

(f) etching and removing the silicon nitride film in isotropic fashion so that a side surface of the silicon nitride film is recessed from a side surface of the base

electrode forming silicon film in the aperture by applying wet etching treatment on the silicon nitride film; and

(g) forming a base region forming epitaxial layer selectively on the semiconductor substrate that is exposed from the aperture.

2. (Original) The method for manufacturing a semiconductor device according to claim 1, after the step (d) and before the step (e), comprising the steps of: applying wet etching on the semiconductor substrate; and removing a part of the first silicon oxide film so that a side surface of the first silicon oxide film in the aperture is recessed from a side surface of the base electrode forming silicon film in the aperture and an aperture size of the first silicon oxide film in the aperture is made larger than an aperture size of the base electrode forming silicon film.

3. (Original) The method for manufacturing a semiconductor device according to claim 1, comprising a step of making the thickness of the second silicon oxide film formed on a region where the first impurity is introduced thicker than that of the silicon oxide film formed on the region other than the first impurity introduced region in the

base electrode forming silicon film that is exposed from the aperture during the step (e), by applying a step of introducing the first impurity into a portion of the base electrode forming silicon film on the side with which the first silicon oxide film is in contact after the step (b) and before the step (c).

4. (Original) The method for manufacturing a semiconductor device according to claim 1, comprising the step of:

(h) removing the entire second silicon oxide film or the exposed portion of the first silicon oxide film so that the aperture size of the first silicon oxide film is made larger than the aperture size of the base electrode forming silicon film in the aperture after the step (g).

5. (Original) The method for manufacturing a semiconductor device according to claim 4, comprising the steps of: after the step (h),

(i) depositing a third silicon oxide film on the semiconductor substrate including the internal of the aperture;

(j) depositing an emitter electrode forming first silicon film on the third silicon oxide film and thereafter etching back the first silicon film;

(k) etching and removing the third silicon oxide film to expose the epitaxial layer from the aperture by use of the emitter electrode forming first silicon film that has been not removed in the etching back process as a mask;

(l) depositing an emitter electrode forming second silicon film on the semiconductor substrate including the internal of the aperture; and

(m) patterning the emitter electrode forming second silicon film to form an emitter electrode.

6. (Original) The method for manufacturing a semiconductor device according to claim 5, comprising the steps of: introducing the second impurity in the second silicon film in the step (e); and diffusing the second impurity in the emitter electrode forming second silicon film into the epitaxial layer to form an emitter region on the epitaxial layer after the step (m).

7. (Original) The method for manufacturing a semiconductor device according to claim 6, comprising the steps of:

removing the first silicon oxide film located near the emitter electrode so that the side surface of the first silicon oxide film is recessed from the side surface of the emitter electrode; and

depositing a metal film on the semiconductor substrate including the emitter electrode and then applying heat treatment on the semiconductor substrate to thereby form a silicide layer on the portion where the metal film is in contact on the emitter electrode and semiconductor substrate.

8. (Original) The method for manufacturing a semiconductor device according to claim 7, wherein the metal film is deposited by means of spattering technique.

9. (Original) The method for manufacturing a semiconductor device according to claim 1, comprising the steps of: before the step (a),

forming a gate insulation film on the semiconductor substrate;

forming a gate electrode on the gate insulation film; and

forming a semiconductor region for source and drain on the semiconductor substrate to thereby form a field-effect transistor on the semiconductor substrate.

10. (Original) The method for manufacturing a semiconductor device according to claim 1, wherein the epitaxial layer is mainly comprised of silicon-germanium, silicon-germanium-carbon, or silicon.

11. (Original) A semiconductor device comprising:

a collector region formed on a semiconductor substrate;

a first insulation film formed on the semiconductor substrate;

a base electrode formed on the semiconductor substrate and the first insulation film;

a second insulation film formed on the base electrode;

a first aperture formed on the second insulation film and the base electrode;

a second aperture that is connected to the first aperture and formed on the first insulation film so as to be recessed from a side surface of the base electrode in the first aperture;

an epitaxial layer that is grown in contact with the base electrode and the semiconductor substrate in the second aperture;

a base region formed so as to be connected to the base electrode and collector region on the epitaxial layer;

an emitter region formed so as to be surrounded by the base region on the epitaxial layer; and

a bipolar transistor embedded partially in the first aperture in a state of being insulated from the base electrode and having an emitter electrode connected electrically to the emitter region,

wherein the aperture width of the second insulation film is larger than the aperture width of the base electrode in the first aperture.

12. (Original) A semiconductor device comprising:

a collector region formed on a semiconductor substrate:

a silicon nitride film formed on the semiconductor substrate;

a base electrode formed on the semiconductor substrate and the silicon nitride film;

a first silicon oxide film formed on the base electrode;

a first aperture formed on the first silicon oxide film and the base electrode;

a second aperture formed on the silicon nitride film so as to communicate with the first aperture and so as to be recessed from a side surface of the base electrode located in the first aperture;

an epitaxial layer grown in contact with the base electrode and the semiconductor substrate in the second aperture;

a base region formed so as to be connected to the base electrode and the collector region on the epitaxial layer;

an emitter region formed so as to be surrounded by the base region on the epitaxial layer; and

a bipolar transistor embedded partially in the first aperture in the state of being insulated from the base electrode, and having an emitter electrode connected electrically to the emitter region,

wherein the aperture width of the first silicon oxide film is larger than the aperture width of the base electrode in the first aperture.

13. (Original) The semiconductor device according to claim 11 or claim 12, wherein the semiconductor device is provided with a field-effect transistor.

14. (Previously Amended) The semiconductor device according to claim 11, wherein the epitaxial layer is comprised mainly of silicon-germanium, silicon-germanium-carbon, or silicon.

15. (Original) A method for manufacturing a semiconductor device comprising the steps of:

(a) depositing a base electrode forming semiconductor film on a semiconductor substrate via a first insulation film;

(b) depositing a second insulation film on the base electrode forming semiconductor film;

(c) forming an emitter aperture on the second insulation film and the base electrode forming semiconductor film;

(d) depositing an emitter electrode forming semiconductor film on the second insulation film and embedding a part of the emitter electrode forming semiconductor film in the emitter aperture so as to be insulated from the base electrode forming semiconductor film;

(e) patterning the emitter electrode forming semiconductor film to form an emitter electrode;

(f) patterning the second insulation film located under the emitter electrode;

(g) etching the patterned second insulation film located under the emitter electrode so that a side surface of the second insulation film is recessed from a side surface of the emitter electrode;

(h) patterning the base electrode forming semiconductor film to form a base electrode; and

(i) depositing a metal film on the semiconductor substrate and applying heat treatment to form a silicide layer on a portion where the semiconductor substrate, base electrode, emitter electrode, and metal film are in contact with each other.

16. (Original) A method for manufacturing a semiconductor device comprising the steps of:

(a) depositing a first insulation film on a semiconductor substrate;

(b) depositing a base electrode forming conductive film of a bipolar transistor on the first insulation film;

(c) depositing a second insulation film on the base electrode forming conductive film;

(d) forming an aperture on the second insulation film and the base electrode forming conductive film so as to reach the first insulation film;

(e) recessing the second insulation film so that an aperture width of the second insulation film is larger than an aperture width of the base electrode forming conductive film in the aperture; and

(f) embedding an emitter electrode in the aperture so as to be insulated from the base electrode forming conductive film.

17. (Original) A method for manufacturing a semiconductor device comprising a step of applying oxidation treatment to form an insulation film that functions as a protection film during epitaxial growing on the emitter aperture prior to selective growing of a base region forming epitaxial layer on a semiconductor substrate that is exposed from a bottom of the emitter aperture.

18. (Original) A method for manufacturing a semiconductor device comprising a step of forming a silicide

layer on the portion where the emitter electrode, base electrode, semiconductor substrate, and metal film are in contact with each other, by depositing a metal film on the semiconductor substrate and applying thermal treatment after a side surface of an insulation film interposed between an emitter electrode and a base electrode of a bipolar transistor formed on a semiconductor substrate is recessed from a side surface of the emitter electrode.

19. (New) A method for manufacturing a semiconductor device comprising the steps of:

(a) forming an oxidation resistance film over a semiconductor substrate;

(b) forming a base electrode forming silicon film of a bipolar transistor over the oxidation resistance film;

(c) introducing a first impurity of a surface portion of the base electrode forming silicon film;

(d) after the step (c), forming a first silicon oxide film over the base electrode forming silicon film;

(e) forming an opening in the first silicon oxide film and in the base electrode forming silicon film such that the opening reaches the oxidation resistance film;

(f) after the step (e), performing an oxidation treatment to form a second silicon oxide film such that a thickness of the second silicon oxide film at a side surface of the base electrode forming silicon film is less than a thickness of the second silicon oxide film at an upper surface portion of the base electrode forming silicon film;

(g) removing the oxidation resistance film at the opening; and

(h) after the step (g), forming a base region forming epitaxial layer selectively on the semiconductor substrate at the opening.

20. (New) A method for manufacturing a semiconductor device according to claim 19, wherein the second silicon oxide film serves as a protection film during epitaxial growing of the base region forming epitaxial layer.

21. (New) A method for manufacturing a semiconductor device according to claim 1, wherein the second silicon oxide film serves as a protection film during epitaxial growing of the base region forming epitaxial layer.

22. (New) A method for manufacturing a semiconductor device comprising the steps of:

(a) forming an oxidation resistance film over a semiconductor substrate;

(b) forming a base electrode forming silicon film of a bipolar transistor over the oxidation resistance film;

(c) forming a first silicon oxide film over the base electrode forming silicon film;

(d) forming an opening in the first silicon oxide film and in the base electrode forming silicon film such that the opening reaches the oxidation resistance film;

(e) forming a second silicon oxide film on the side surface of the base electrode forming silicon film that is exposed from the opening by performing an oxidation treatment;

(f) removing the oxidation resistance film at the opening; and

(g) after the step (f), forming a base region forming epitaxial layer selectively on the semiconductor substrate at the opening.

23. (New) A method for manufacturing a semiconductor device according to claim 22, wherein the second silicon oxide

film serves as a protection film during epitaxial growing of the base region forming epitaxial layer.

24. (New) A method for manufacturing a semiconductor device according to claim 22, further comprising the step of:

(h) between the step (b) and the step (c), introducing a first impurity of a surface portion of the base electrode forming silicon film,

wherein, in the step (e), the second silicon oxide film is formed such that a thickness of the second silicon oxide film at a side surface of the base electrode forming silicon film is less than a thickness of the second silicon oxide film at an upper surface portion of the base electrode forming silicon film.

25. (New) A method for manufacturing a semiconductor device according to claim 1, further comprising the step of:

(h) between the step (b) and the step (c), introducing a first impurity of a surface portion of the base electrode forming silicon film,

wherein, in the step (e), the second silicon oxide film is formed such that a thickness of the second silicon oxide film at a side surface of the base electrode forming silicon film

is less than a thickness of the second silicon oxide film at an upper surface portion of the base electrode forming silicon film.

26. (New) A method for manufacturing a semiconductor device according to claim 22, wherein, in the step (f), the oxidation resistance film is removed such that the oxidation resistance film is recessed from a side surface of the base electrode forming silicon film in the opening by applying wet etching treatment on the silicon nitride film,

and wherein the oxidation resistance film is a silicon nitride film.

27. (New) A method for manufacturing a semiconductor device comprising the steps of:

(a) forming a base electrode forming silicon film of a bipolar transistor over a semiconductor substrate;

(b) forming a first silicon oxide film over the base electrode forming silicon film;

(c) forming an opening in the first silicon oxide film and in the base electrode forming silicon film; and

(d) forming a second silicon oxide film on the side surface of the base electrode forming silicon film that is exposed from the opening by performing an oxidation treatment.

28. (New) A method for manufacturing a semiconductor device according to claim 27, wherein the second silicon oxide film serves as a protection film during epitaxial growing of a base region forming epitaxial layer.

29. (New) A method for manufacturing a semiconductor device according to claim 27, further comprising the step of:

(e) between the step (a) and the step (b), introducing a first impurity of a surface portion of the base electrode forming silicon film;

wherein, in the step (d), the second silicon oxide film is formed such that a thickness of the second silicon oxide film at a side surface of the base electrode forming silicon film is less than a thickness of the second silicon oxide film at an upper surface portion of the base electrode forming silicon film.

30. (New) A method for manufacturing a semiconductor device according to claim 27, wherein after the step (d), an

oxidation resistance film formed under the base electrode forming silicon film is removed such that the oxidation resistance film is recessed from a side surface of the base electrode forming silicon film in the opening by applying wet etching treatment on the silicon nitride film, and wherein the oxidation resistance film is a silicon nitride film.

31. (New) A method for manufacturing a semiconductor device according to claim 27, further comprising the steps of:

(e) after the step (d), removing, at the opening, an oxidation resistance film formed under the base electrode forming silicon film; and

(f) after the step (e), forming a base region forming epitaxial layer selectively on the semiconductor substrate at the opening.